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AUTHOR Wall, James E.
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ABSTRACT

In order to derive social benefits from technology, its impact must be studied. Technology is a double-edged sword, promoting human and societal values and disrupting social institutions by increasing the rates of change and growth in areas such as population and life-styles. Vocational education offers a means to begin bridging the ever-widening gap between the individual needs for lifelong continuous learning and vocational adjustment and the demands of an increasingly complex technological society. The failures of educational institutions must be studied in order to produce an informed citizenry who are capable of adapting to and directing change. Local educational programs must be developed so that individual identity and human values can be preserved, in the face of tremendous personal adjustment and socialization pressures. (AG)

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TECHNOLOGY AND SOCIAL CHANGE: SOME IMPLICATIONS FOR VOCATIONAL EDUCATION*

by
James E. Wall, Assistant Dean (R&D)
College of Education
Mississippi State University

The central concerns of this paper are technology and social change, and their concomitant implications for vocational education. Viewed together, technology and social change comprise an extremely complicated two-dimensional matrix of inter-related concepts, trends, and factors. The major aim of this paper is to briefly review some of these factors associated with technological advance which appear to need closer scrutiny and study because of the manner in which they impact on society. Attempts will be made to relate these factors to the discipline of vocational education.

A review of technological advance is something which should be ongoing or perpetual. The accelerating tempo of technological advance alone necessitates that it be subjected to a cyclical review process. The exponential, multiplier dimension of technological advance also emphasizes the need to review it in terms of societal implications and its potential effect on the man-made institution of education.

The reasons for studying technology and social change are many and varied. One reason for such study is that society both embraces and rejects the results of technological advance. We view these results with ambivalence. For example, we embrace the automobile because of the freedom of action it affords us, but we simultaneously reject it because it pollutes the environment, or maims and destroys life on the highway.

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Another principal reason for studying technology and social change is to dispel any mistaken notion which holds that all disagreeable aspects of our contemporary society are results of accelerating technological advance. Many of the faults of present-day society rest with manipulators of change who are willing to sacrifice human values for other objectives, such as economic growth and profit. Hence, not all our social ills are attributable to technological advance.

Another reason for studying technology and social change is that it is highly unlikely that any society will ever deliberately arrest its technological advancement; i.e., there will be no technological regression. Therefore, whether we want to or not, we must be concerned with <u>quality</u> of technological advance as well as with quantity.

Still another reason for such study is that regardless of what a person's specific vocational interest may be, he sooner or later will always find himself concerned with social trends, processes of change, and societal expectations. A slightly different reason is that unless every citizen gains some degree of understanding of technology and science, society runs the risk of becoming effectively controlled by a scientific-technological hierarchy which could be as pernicious as every other type of cloistered elite. What is needed is a society where everyone shares at least common basic rudiments of a scientific-technological culture. After all, this is the composite make-up of the modern world.

Another reason for studying technology and social change lies in the well-known fact that multi-faceted social and other similar kinds of problems require multi-faceted approaches to solving them. Each social problem that arises has its own set of characteristics or factors. The number of factors vary for each problem over time; the dominance among factors is never equal; and the matrix itself is undergoing constant change. In actuality, we are never able to list more than a fraction of the characteristics or factors

impinging on a single social problem that is of any great consequence, much less determine and measure the magnitude and intensity of impact of each characteristic at given points in time and in given action events. Under such conditions exact prediction becomes theoretically impossible, for we could never put enough information or data into the system to precisely describe the problem. One major difficulty in dealing with social problems seems to be that we experience trouble in holding things still or constant long enough to study them. The dynamism of social problems precludes this.

The entire concept of technological advance and related social change is such that study of its impact can be viewed as endeavoring to derive the benefits of the constructive side of technology; i.e., how technological advance has contributed to the enjoyment of the "good life"; while at the same time controlling the destructive side; i.e., the mass destruction devices, weapons of war, and those things which cause personal disorientation, frustration, and anomie.

AMBIVALENCE

As mentioned before, we view technological advance with varying degrees of ambivalence, one determinant here being the extent to which our individual motives and incomes tend to insulate us from the undesirable side effects of the technology.

The ambivalence surrounding technological advance is seen in many different forms. Some ambivalence arises when technological advance tends to unbalance the ecological equilibrium. Examples of such effects can be readily seen when animal and plant life are eliminated by controlled air and water pollution. Another example, and one that is somewhat more complex because of the human factor, is seen when attempts are made to upgrade underdeveloped countries. The introduction of new technology in medicine, agriculture, and

the like, in underdeveloped countries usually always increases the standard of living; i.e., basic necessities of food, clothing, and shelter become easier to obtain. The net result is an almost immediate rise in the country's birth rate, which in turn imposes additional stress or demand on food supplies, but which has its greatest residual effect in the field of education where the demand for school teachers and buildings becomes acute. The problem albeit oversimplified here, is that the new technology has been introduced from an external source. Had it originated internally, the social situation may have been more conducive to coping with the technological impact.

The ambivalence surrounding technological advance in the United States is of a somewhat different nature. Here, technological advance causes man to need and acquire more education. Better educated man becomes a better wage earner. He develops the affluent bent and becomes a greater consumer. The so-called "market system" reacts to man's consumptive demands by bringing about the production of more goods and services. Spin-off effects of the increasing rates of production cause increases in residuals in the form of wet and dry solids, or wastes suspended or dissolved in water, or pollutant-laden gases released into the air. Coping with the residuals that pollute the environment is a complex problem, the technicalities of which must be left up to scientists, engineers, and technologists. According to some experts, solutions for handling most residuals, with the exception of carbon dioxide, are technologically within reach, with solids alone being the irreducible residual. The major drawback in handling residuals is cost: Who will pay?

The complexity of the environmental problem calls for coordinated scientific-engineering-economic-political-management-educational programs tailored to meet the different situations in the various regions of the country, in the various industries, and in the various social situations.

Attacks must be made along the entire production-consumer continuum. There are at least three main factors which need to be considered: (1) Problems of improving the quality of air, water, and land need to be approached concurrently and in coordinated fashion. (2) Production wastes must be dealt with in a more systematic manner than in the past. (3) Most of the costs for controlling both production and consumption wastes must fall on those who produce or engender them; i.e., wastes should be viewed as inseparable parts of the total process of production and consumption. All these things call for special forms of alliances between agencies and industries and man-made institutions, such as education.

There have been many social concomitants to technological advance. One is that while technology was advancing, human values were changing. Through specific innovations and through its pervasive "objective spirit" (reliance on superficial observation to determine good vs. bad), technological advances have successfully challenged the values and life-styles of traditional cultures, including the culture or cultures found in the United States. The characteristics of this cultural change are highlighted in the following examples.

The "prudential ethic" has been the real power behind many of our behavior patterns. This ethic has caused society generally to view extra-marital chastity as being "good" and desirable. Infection, detection, and conception have been used to create and concretize this view. In other words, extra-marital adventures subjected one to the risks of contracting a venereal disease, or being caught and having to endure public shame, or becoming a parent, or all three. But the "prudential ethic" has begun to decline according to most statistical trends. Medical technology has produced wonder-drugs which cure venereal disease; the automobile and motel room offer almost fool-proof privacy; and the "pill" has reduced unwanted pregnancy to a minimum. Technology, then, has dealt a body-blow to the "prudential ethic" and apparently is on the way toward making it powerless as a value determinant in society.

Similarly, the "protestant ethic" has been the driving force that yoked man's identity firmly to his work. This ethic reinforced our beliefs that personal satisfaction and success were gained through hard work, thrift, and occupational integrity. But automation (substitution of mechanical processes for human muscle and dexterity) and cybernetics (substitution of electronic circuity for mental or cognitive skills) have massive capacity to impact on societal values, even when taken separately. And when linked together, as in the cybernation concept, their combined functional capacity to eliminate jobs is geometrically increased. The effects of cybernation are best seen in the oil refining industry where almost all jobs except the custodial and top management jobs have been eliminated. The baking and lumber industries also are rapidly moving in that direction. Vast social and economic dislocations are bound to result from this development. Such development might be viewed with a spirit of discouragement, but that viewpoint will cause us to miss the central point which is that our social problems stem not from total failure but from partial success, which is a slightly more optimistic angle to the viewpoint.

Two ideas which have been advanced as possible solutions to the dislocation problem have been welfare payments and negative income tax. But these solutions do not give consideration to such questions as: What happens to the man, or woman, who is permanently excluded from the productive enterprise; i.e., the man, or woman, who does not possess marketable work skills? And, although the public dole may sustain the welfare recipient, what happens to that individual's self-esteem or dignity as a human being.

Another example of changing human values is seen in the erosion of the value-forming power of the family unit under the impact of technology. Many familial functions of the past have gradually been taken over by such

institutions as schools, churches, hospitals, and informal organizations. More recently, the rapidly increasing mobility of youth has exposed children to extra-family ideas and concepts; the wide world is televised into the family living room.

Nowhere is the impact of technology more obvious than in the areas of the family and human values which relate to social structure. Basically our society is structured to meet three universal needs. These are production, socialization, and social control. The production need is met through a network of economic institutions, the market system, and interrelated processes of distribution. This network is sometimes termed the "community of work." It is in the community of work that technology has had its greatest impact. Decision-making apparently is centralized in the economic world, and consequently most major decisions are made and implemented comparatively rapidly, all of which has created an environment that is conducive to technological progress.

The second universal need, that of socialization, is met through primary groups such as the family, the church, and the school. These primary groups are combined into an area called the "community of residence." We have relied on the community of residence as the mechanism for transmitting moral and social elements of our culture. Now there are some who believe that busing school children is destroying what little we have left of the "community of residence."

The third universal need, that of social control, operates wherever human action takes place. Informal controls are more commonly found in the community of residence; whereas legal, law enforcement, and other formal controls are prominent in the community of work.

As technology has advanced, the community of work and the community of residence have become more widely separated and differentiated. Formerly, when America was largely rural, we resided and worked in the same place, on the farm. Production decisions, consumer decisions, and especially work values were all formulated within the same relative context: the rural family. But the gradual separation and differentiation of the community of work and the community of residence have disrupted this process. The net result is that work usually is now almost totally unrelated to residence. The initiation of youth into the world of work is more complicated now than it formerly was because urbanization has progressed as far as it has and employment is away from home, frequently requiring a physical move over some distance to take a job, or to get training for a job.

The chain-like transmission process for transferring elements of our work culture has been disrupted. Fathers no longer teach their sons and daughters how to work, nor do fathers instill in them the values of hard work, thrift, etc. This problem is magnified in absentee-husband families. But this doesn't really depict the magnitude of the gap. Technological advance is such that nowadays fathers can't really understand the nature of the work that their sons perform.

Thus we see the advance of technology both as a generator of some difficulties and as a possible solution to others. The technological picture is painted in vivid color and is depicted in detail by massive quantities of statistics. The following are only a few items which highlight the technological impact.

(1) The phenomenal results of the process and extent of technological advance can be portrayed by placing a stone ax on one end of a continuum and a space vehicle or submarine research vehicle on the other. Man has transformed

his immediate environment into one of material culture, and consequently himself into civilized man, by means of technological tools and languages.

(2) We are witnessing a "knowledge explosion." Ninety percent of all scientific knowledge ever produced and put into recorded form has been produced within the last 15 to 20 years. This accumulation of "collective intelligence" has been brought about because ninety percent of all the scientists who ever lived are alive today.

(3) We are experiencing population explosion (growth) and population implosion (concentration). There were one billion people in the world in 1850, three billion in 1960, and upwards of six billion expected in the year 2000. People have concentrated in megalopolitan areas until we already are in serious trouble with overpopulation and congestion. By 1980, 80 percent of the U. S. population will reside in metropolitan areas. Wealth has always been judged by how much privacy it could buy. Only the most affluent will be able to afford physical privacy by the year 2000. For the common man, privacy has already become merely a state of mind. Note the passive look on the faces of the crowd riding the subway, waiting to cross the street, etc. Note the complacency of citizens while witnessing acts of crime and violence.

(4) According to the National Planning Association:

-- In 1970 our gross national product (GNP) exceeded $1 trillion. By 1980 it will be $2 trillion.

-- In 1960, 81 million Americans held jobs. By 1980 there will be 100 million persons in the labor force.

-- In 1969 we spent $580 billion on food, fun, health, housing, education and other personal items. In 1980 we will spend $1.2 trillion, or twice the amount spent in 1969.

(5) The major quality of the American economy is CHANGE, highlighted by growth in gross national product (GNP), much of which is due to our two greatest resources: technology and an educated people. However, the very

notion of gross national product can be a kind of trap into which we all tend to fall. The U.S. and other nations have striven as a matter of national policy, national pride, and international competition to increase GNP as rapidly as possible. Included in the GNP frequently not only is the value of tne final goods and services that are consumed, but in some cases, also the expenditures for preventing and controlling the accumulation of residual rubbish or for disposal of it. The environmental damages wrought by industrial and other operations do not enter the GNP calculation on the negative side. Nearly all forms of environmental pollution are parts of one large problem: how to manage the residuals generated by production and consumption activities of the population.

(6) One of the most astounding problems confronting the entire world today lies in the fact that the growth of world law and order is still lagging disastrously behind the upsurge of destructive technology. A cooperative, coordinated agreement as to control of mass destruction devices simply has not yet been agreed upon as to its form and content. It is a sobering thought to realize that absence of such a control agreement could easily nullify all our best efforts to build the ideal society wherein every able-bodied person is engaged in satisfying employment and leading a graceful and gracious life.

IMPLICATIONS OF THE FOREGOING FOR VOCATIONAL EDUCATION AND EDUCATION IN GENERAL

All of the foregoing is merely a collection of sporadic notes, a potpourri of data, ideas, and notions. They were neither arranged in any particular logical order, nor were they viewed as being anything like a complete set of approaches to solving problems concomitant to technology and social change. The entire concept of technology is awesome and its potential impact

on social change is almost inconceivable. Nevertheless, membership in a technologically advanced and advancing society is a privilege. Privileges can be put to good use or to bad use. The privilege is collective by nature; i.e., the benefits and the evils depend far more upon aggregate behavior than upon individual behavior.

But to prepare persons for membership in a technological society we must start with the individual, for he is the human constant in the midst of rapid change. Education is charged with providing the individual with instant experience, instant knowledge, instant adjustment, and instant competence, to meet the challenges of the future technological society. The educated individual as a consumer is important; i.e., the more education one has, the more he earns, and the more he consumes. Therefore, it is interesting to note that education, especially vocational education, is equated with productivity, thus with the basic wealth of the nation. The question then becomes one of how education can share in the wealth it helps create in order to provide the regenerative power for national progress. One answer is for all forms of education to be continuously focused on the individual.

Technology has made life expectancy at a given age much greater than it was in the past. Thus, we are "richer" in the most unambiguous form of wealth--years of life. While at first glance this seems like an unquestionable boon, we become ambivalent about it to some degree when we realize that some people are "cast out" after passing a certain age; society has "no use" for them. Formerly, the elders performed important roles as society's informed people, as its teachers. But now they are superseded by libraries, and computerized data-storage retrieval systems, while the knowledge they traditionally conveyed is made obsolete by the progress of technology and science. There is no role for them. In a way, then, while life is lengthened, its later years

are emptied of meaningful content. Our society has gained longevity but has not yet found out what to do with it.

Knowledge will continue to increase exponentially and probably will double in amount by 1980. Education must greatly improve its data storage and retrieval systems in order to avoid the waste that is incurred in duplicating experiments and studies due to the inability to find what is already known. Compared to certain other disciplines, such as agriculture, education has accumulated a relatively small body of basic research information. It has formerly relied rather heavily on other disciplines like psychology, sociology, etc., to furnish research information. For the past twenty years, however, the trend has been toward the development of research oriented personnel in education and the development of structures necessary for the derivation of information and the diffusion of educational innovations. The rise in the last few years of regional education laboratories, educational research and development centers, and research coordinating units is indicative of the growth trend in establishing programmatic approaches to educational research as opposed to small-project type studies that were conducted largely in isolation.

The impact of technological advance has played a role in causing many ideas to be in conflict. Value choices between the young and the old ("generation gap") complicate the struggle between traditional and progressive approaches to education. Research is needed for careful selection on experimentally tested bases of the best from the past and the present. Research also is needed on the equally careful use of progressive technological and social inventions which have been proven under simulated conditions. Procedures need researching to discover how to improve the rationality of decisions and choices as to what education should be doing.

From the individual person's standpoint, education must be continuous, from preschool through retirement. Education and training are not completed at some young age, but must be cycled continually through a person's life. To a certain extent, career education is a stab in this direction. Individualization of instruction on a self-learning basis is needed for this continuous cycle. Educational curriculum developers must master retrieval technology in order to prepare materials that can be intelligently selected by the individual for his self-learning activities. The end result which education must be focused on attaining is how to maintain individual identity, either in isolation or in groups. The individual need not be in competition with any other person for his education. The individual will need the ability to measure continuously his own improvement, particularly his ability to behave not only in terms of what he knows, but in relationship to what appears to be desirable and acceptable behavior. Technology has presented us with instant communication. The organization of various tele-communication devices into a coordinated console arrangement is pertinent to the teacher's task, to the student's self-learning efforts, and to the adult's continuing education.

The accelerating pace of technological change has sharpened the dilemma between what men must know and their anxiety over what kind of person a man should become: the traditional vocational-liberal dilemma. Increasing differentiation of societies and more rapid change raise our concern for insuring adequate socialization of youth into a common culture. This is the problem of moral education in one guise. While postponing vocational choice and lengthening prevocational education, we struggle to insure that educated men will not be mere robot technicians. This is one reason why the liberal arts had to be revived and expanded in the "agricultural and mechanical arts" (land-grant) colleges.

Technological advance has been instrumental in creating many new kinds of occupations and has increased the need for specialization because of subsequent differentiations in the division of labor. This impact is manifest in statistics that show increases in educational attainment. In 1900 barely one person in 20 obtained a high school diploma; today, two in three do so. Students go to college in great numbers, but less than a sixth of our youth ever finish the baccalaureate degree.

While technological advance generally has afforded us a high level of living, our total satisfaction level could be greater if opportunities for achievement were more evenly distributed among the people. The pace of technological advance, the pace of expansion in educational needs, the rate of obsolescence in human skills, the rate of material capital turnover and accumulation -- all of these are creating enormous pressures to adjust. The gap between what actually is and what really needs to be is widening. Our capacity to understand change and its necessary adjustments is not increasing fast enough to keep up with population shifts and the increasing complexity of self-government. Although some of our leaders do seem to understand some of these problems, this understanding fails to reach down far enough to the common citizenry to facilitate rational public choices at local levels. With all its shortcomings, education still would seem the best mechanism to prepare a truly informed electorate for operating a democracy. But when we look in detail at the educational institution, it contrasts sharply with our excellent capacity to innovate, and to master and manipulate material objects in our physical and biological environment.

Technological advance, then, is a double-edged sword which creates new opportunities in one place, but often destroys opportunities in another.

It has been estimated that many individuals will change jobs as many as six times in their working life. These persons will require re-education three or more times. Policies and structures for such re-education have not as yet been formulated, but the need for this kind of education is increasing. Relevant facts for making decisions about such educational programs must be assembled, synthesized, and communicated. The unique aspect of such facts is that they must be specifically localized, for after all, it is at the local level that social and economic adaptations are made.

The general function of education, therefore, seems to be to prepare an informed citizenry for governing the nation intelligently, and for adapting to and directing change. The question arises: HOW? One of the best ways is to invest in constant study of the many ways by which the institution of education can fail. The only way to find operational gaps (gaps between research and practice) is by intense observation of the whole system, reflection on unconventional possibilities, and various other studies. If we but look around, I believe we can agree that a beginning has been made in vocational education, but ever so much more needs to be done.

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